Heartwater surveillance in Guadeloupe: a model of partnership between research and surveillance for the Caribbean

CARIBBEAN ANIMAL HEALTH NETWORK

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Background

Heartwater: fatal tick-borne disease (TBD) for ruminants in Africa and the Caribbean. Major constraint for livestock development. Due to *Ehrlichia ruminantium,* transmitted by *Tropical Bont Tick (TBT)*

- From peracute forms with nervous symptoms & high hyperthermia to mild disease.
- Exotic cattle breeds & small ruminants more sensitive
- If animals survive natural infection: life-long immunity but NO cross protection between strains…

1-Nervous symptoms: trembling, with stiff & uncoordinated gait, falls and lies in opisthotonos.2 - hydopericardium

TBT, *Amblyomma variegatum*: invasive species & threat for the USA.

1995-2006: Eradication programms (POSEIDOM, CAP*), tick control subsidized & implemented by farmers associations → TBT not eradicated from the region, mitigated results according to islands.

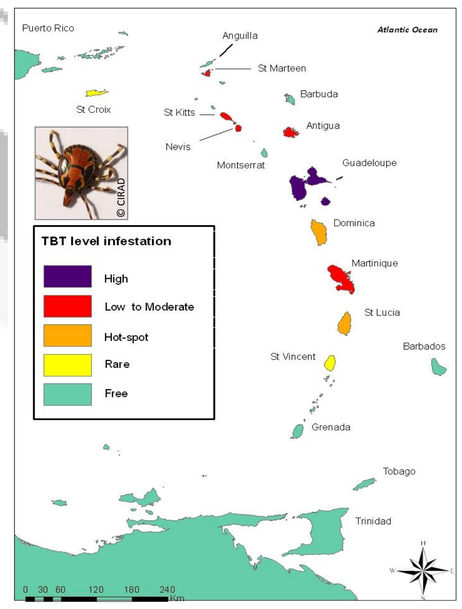
Since 2006: Farmers responsible for acaricide treatment. Reluctancy to adopt efficient protocol (Bayticol every 2 weeks).

Challenges → Tick control uneffective, incomplete knowledge on Heartwater epidemiology and evolution, risk of disease spread, no vaccine available yet, no disease monitoring.

T&TBD* working group of CaribVET recommended to highly infested islands with heartwater to implement:

- **Sociological Study:** to understand farmers reluctancy (2010)
- **Heartwater surveillance:** to monitor case and assess evolution.

July 2010 → Setting-up of a passive **syndromic surveillance network of neurological syndromes in ruminants** in Guadeloupe – "**RESPANG*"** to **strengthen field health workers** and in **tight link with research and CaribVET**.



TBT Status in Lesser Antilles. Heartwater found in Antigua, circulates in Guadeloupe and Marie-Galante.

Objectives

Strengthen field animal health Network & Improve Heartwater control in Guadeloupe

Support research: improve knowledge on Heartwater Epidemiology, Diagnostic and Vaccine strategies

Materials & methods

Awareness campaigns for TBT control (GDSG*)

- **Targets:** ruminant owners & farmers.
- **Communication materials**: leaflets, roll-up, power points displayed and distributed during ad-hoc communes meetings and during agricultural manifestations.
- **Objective**: to make Animal owners realize that TBD can kill animals, that it is important to control ticks and to explain how.
- **Key messages**

- Developed by GDSG, based on the observations & recommendations of the sociological study.
- Tested with farmers

Surveillance protocol

- Formalise objectives, operation & roles of actors
- SC*: 1 representative of DAAF, CIRAD, GDSG & Vet. Association
- Co-funding: Vet. Service Guadeloupe, CIRAD

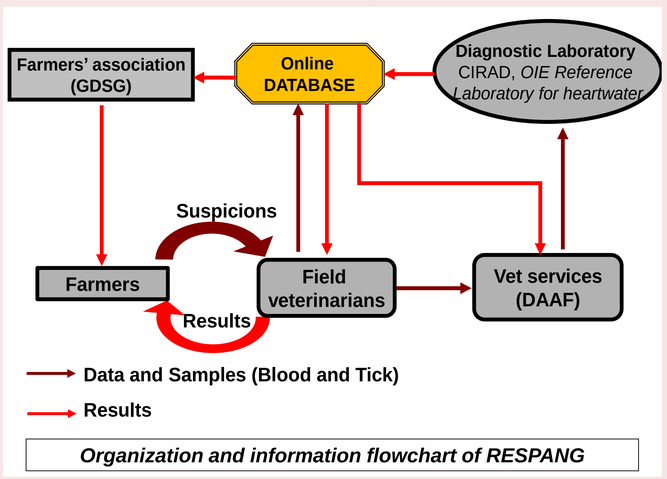
Communication between partners

- Annual SC Meetings,
- Information bulletins, info-days for Vets

Multiuser online database

- Developed by CIRAD Guadeloupe
- Data centralization, real-time feedback of results (maps) accessible to all actors
- Specific rights according to role

RESPANG Operation



Organization and information flowchart of RESPANG

Case definition

"Ruminant with marked modification of general condition, hyperthermia or constipation and nervous symptoms or sudden death". Cattle identification: necessary for subsidies.

Diagnostic tests

Molecular diagnostic (PCR) on all samples

- Heartwater (*E. ruminantium*) [+]
- Babesiosis (*B. bovis* & *B. bigemina*)
- Anaplasmosis (*A. marginale, A. ovis)*

[+] CIRAD Guadeloupe: OIE Ref. Lab for Heartwater, accredited 17025 norm. Highly sensitive & sensible test. Detection limit: 6 DNA copies

Genetic characterization of strains of *E. ruminantium*

- Partnership with other research projects
- 2 Genotyping methods used :
  - Variable Number Tandem Repeat (VNTR)
  - Multi Locus Sequence Typing (MLST)
- Comparison with other genotypes from the Caribbean, West & South Africa & Indian Ocean.

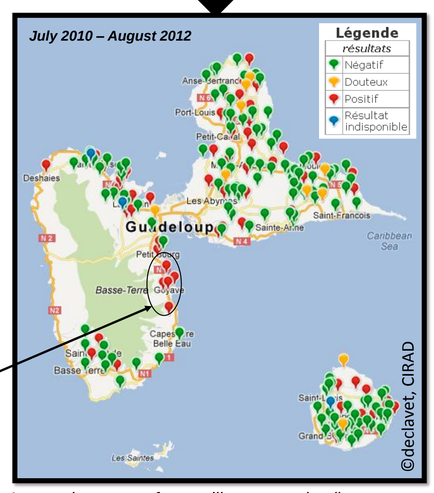
Results

Excellent partner involvement and interaction

- 3 SC meetings, 6 bulletin issues, 1 info day for vets, 1 feedback meeting with all actors (planned end of 2012).
- 15 vets participate regularly and declared 375 samples since July 2010. Each month, 4 to 6 vets submit 11 to 19 blood samples.
- Improvement of data collection: ↘ Missing data, ↑ Geolocation, ...
- Topics developed in Bulletin: based on most FAQ (vets, GDSG, DAAF): lab results interpretation, differential diagnostic, literature review on other TBDs in Guadeloupe, case studies, …

Awareness campaigns

- **March-October 2011-2012**: Weekly information at draught cattle competition (traditional)
- **Pilot awareness campaigns:** organised in the 7 most affected communes (GDSG/CIRAD) – Last meeting very successful, to be implemented routinely. Impacts to evaluate.



Interactive map of surveillance results (heartwater results). Users can select period & disease.

Evaluation of diagnostic test for *E. ruminantium*

Observation: Negative results despite strongly suspicious cases…

- 173 "-" samples retested twice →13 (7,5%) & 8 (4,6%) first tested "-" were found "+" or "weak +" resp. after 2nd & 3rd testing.

→ limit of detection, but no need to test "-" samples twice

→Influence of Antibiotic treatment prior to blood sampling: ↘ bacteraemia , ↑ "false -" → Vets/farmers sensitized

Genetic diversity of *E. ruminantium* in Guadeloupe

=> Preliminary results

- 49 samples "strong +" genotyped by VNTR method, comparison with 7 reference strains

➔ 29 genotypes identified

- Next steps:
  - MLST for complete genotyping,
  - Genetic and epidemiological analysis: strains geographic diversity, evolutions and origin.

		RU6	RU 11	RU13	RU14	RU15	RU 19
1	17-07-JMR-01	1	1	1	1	1	1
2	22-07-AS-01	2	1	1	2	2	1
4	20-07-AS-02	2	1	1	2	3	1
13	21-12-JCA-01	2	1	1	2	2	1
16	22-12-JCA-01	3	1	1	2	2	1
19	02-02-BP-01	3	1	1	2	3	1
24	08-03-JMR-01	4	1	1	2	3	1
25	21-03-JMR-01	2	1	1	2	3	2
26	21-03-JMR-02	2	1	1	3	3	1
27	21-03-JMR-03	3	1	2	2	2	2
29	29-03-JMR-01	2	1	4	3	3	1
30	13-04-MC-01	3	1	4	3	4	1
33	27-04-AS-01	1	1	1	1	1	1
34	02-05-CM-01	3	1	4	2	2	2
36	14-05-BP-01	3	2	4	3	4	1
39	20-08-FB-01	3	1	4	1	1	3
40	24-08-FB-02	1	1	1	1	1	3
41	03-09-FB-01	2	-	1	2	3	1
42	15-09-JE-01	-	1	1	1	1	1
45	16-11-11-MM-01	2	2	4	-	3	1
47	02-01-12-JMR-01	2	1	1	2	2	1
48	29-11-11-FB01	2	1	-	2	2	1
Guadeloupe	**Gardel**	3	1	4	2	2	2
Senegal	Sénégal	4	3	2	4	1	1
South Africa	Welgevonden	2	4	3	3	3	4
	Mara	3	2	2	2	1	1
	Umpala	2	1	2	2	1	1
	5697	2		1	multi	3	1
	Bekuy 255	4	3	2	5	1	3

Preliminary results of genetic diversity

TBDs diagnosed in Guadeloupe

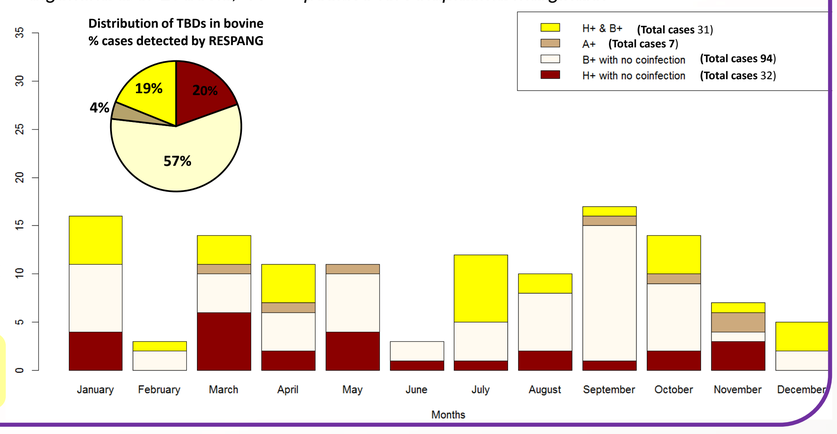
- **Heartwater:** diagnosed in **53.8% and 23.4% of SR* & bovines suspected** resp.
- **Babesiosis:** ***Babesia spp.*** in 50.2% of suspected bovine. **Clinical babesiosis in 34.4% of suspicions, misdiagnosed in 68% of cases.**
- **Anaplasmosis**: 7 cases detected

Tool to determine appropriate treatment?

Analysis of symptoms on Heartwater & Babesiosis show no significant difference→ Symptoms cannot help vets to decide on appropriate treatment.

➔Enhanced awareness of private vets to TBDs in Guadeloupe and in the region

Monthly distribution of TBDs detected in cattle (07/17/10 – 07/05/12)
(sums of monthly figures). *"H+" = positive for E. ruminantium; "B+" = positive for B. bigemina &/or B. bovis; "A+" = positive for Anaplasma marginale.*



Communication with regional stakeholders

- **Impart new knowledge** and promotion of RESPANG and the integrated surveillance-research approach with the CaribVET T&TBD working group.
- All Caribbean countries sensitized to Heartwater are invited to ship blood samples to CIRAD in case of clinical suspicions for early detection and subsequent control plan implementation.
- Regular updates of Heartwater distribution maps in the Caribbean.

Conclusion & Discussion

Discussion

- Regular communication & exchanges between partners; level of vets investment in the network satisfying; useful datasets & biological samples collection for further research, to be analyzed with epidemiological data.
- **Communication campaigns**: to implement routinely for optimal benefits of the Network & assess their impacts on TBT infestation & heartwater level of circulation.

Perspectives

- Performance indicators : improve RESPANG's functioning
- Develop website and automatic analysis to ease network animation
- Enhance vets sensitization on exotic diseases with nervous signs: Rabies, BSE*, …
- Design a Pilot study for applied research relying on RESPANG participants:
  - Isolate new *E. ruminantium* strains from the field and test cross-protection for vaccine preparation
  - Vaccination Field trial (potential time frame: 1 year)
  - Diagnostic of other Ricketsia on negatives samples (PCR on 16S gene).

Conclusion – RESPANG, a model for the Caribbean islands

Caribbean countries/territories encouraged to adopt similar approaches for their priorities: strengthen animal health networks, reinforce control based on research outputs (diversity, vaccine)

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BSE: Bovine spongiform encephalopathy; CAP: Caribbean Amblyomma Program, GDSG: Groupement de Défense Sanitaire de Guadeloupe; RESPANG: Réseau d'épidémiosurveillance des Pathologies Nerveuses des Ruminants de Guadeloupe, SC: Steering Committee ; SR: Small Ruminants; T&TBD: Ticks and Tick-Borne Diseases